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PROGRESS REPORT TO
NATIONAL AERONAUTICS AND SPACE AGENCY
Research Grant No. NgS-497/39-010-004

to

University of Pennsylvania

UNPUBLISHED PRELIMINARY DATA

for research entitled

Effects of Research and Development Expenditures
Upon Local and Regional Economies

The major part of the research effort was devoted to the construction of a Greater Philadelphia region input-output table. This effort was outlined in a previous report. It is now clear that we will be able to develop a table which will be at least 350 by 350 in size. We shall be able to develop a set of coefficients on detailed material inputs for all but a few of the 4-digit SIC industries in the Philadelphia region. The research has gone far beyond the initial effort by the Penn-Jersey Transportation Study. All the materials collected by the Penn-Jersey Transportation Study have been utilized. In addition, we have contacted numerous firms in the Philadelphia region and have successfully obtained necessary data by direct interview. Materials from the U. S. Census of Manufactures, the Department of Employment Security, and State Government Agencies in Harrisburg have been collected and compared in order to furnish the basis of estimates of total outputs by 4-digit SIC categories. Materials from the same and other sources on employment, value of shipments per employee, and number of firms have been brought together in order to obtain best estimates for use in the input-output table.

Preliminary work was also begun on the possible application of the extensive set of Philadelphia coefficients for the study of the impact of NASA facilities in other large metropolitan regions. In particular, work was begun on the construction of a Boston regional input-output table based upon data from

the U. S. Census of Manufactures, Department of Employment Security, Boston Regional Planning Project, Massachusetts Census of Manufactures (Department of Labor and Industry), Federal Reserve Bank, New England Council, and other sources.

In the next semi-annual report, a fuller presentation of the input-output research will be given.

2. Much effort has been devoted to an investigation of subcontracting patterns and operations of defense and space industries. This research essentially involved three phases: study of the concept, philosophy, and techniques of subcontracting in American industry; study of the subcontracting patterns of four large defense-space manufacturers in the Philadelphia region; and study of the subcontracting patterns of major prime contractors of the National Aeronautics and Space Administration.

The first phase of this research had as its goal a definition and description of the subcontracting process as developed by American industry. Starting with a thorough review of existing literature and supplemented by intensive interviews with numerous manufacturers in eastern U. S., the study sought to develop a more reliable and accurate definition of subcontracting. Subcontracts are defined to range from the simple, "off-the-shelf," catalogue purchase to the procurement by a prime contractor of a complex, highly specialized one-of-a-kind, component. The investigation produced information which outlined the scope of this procurement process and analyzed its relationship to decision-making problems.

The second phase of the research described and analyzed the subcontracting patterns of four large defense-space manufacturers in the Philadelphia region. This investigation involved the processing of all procurement actions of these firms. Data were processed which defined each procurement action as to place,

industry type, number of actions, and value. These data were then analyzed to reveal their industrial and geographic patterns and relationships.

The third phase of the research sought to complement the preceding studies by analyzing information of the subcontracting patterns of major prime space contractors. The National Aeronautics and Space Administration has collected voluminous data from its major prime contractors in an attempt to assess the regional impacts of its procurement. Several weeks were spent at NASA headquarters in Washington, D. C., during which time discussions were held with NASA personnel and related research personnel to ascertain the scope and reliability of the subcontracting reporting program. Pertinent data from this program were subsequently processed and analyzed to reveal industry and geographic patterns and relationships.

3. Another research study proposes to continue the construction of econometric models of the regional economy to simulate:

a. the long-term economic trends of the region, and

b. its short-run cyclical movements.

One model, which is described below, is a recursive one which employs the following three groups of exogenous variables:

a. national indices,

b. policy decisions of the federal government affecting the Philadelphia area, and,

c. selected policy decisions of the state and local governments.

Only the second and third sets of variables are instrumental ones.

The output of the model will consist of projected levels of economic activity---output, employment, etc.---given some assumed investment decisions of the federal government, and/or economic measures of the state and local governments.

The first stage of the research is the assembling of data. In addition to data derived from the input-output table under construction, and the Penn-Jersey Transportation Study, several series were collected. In all cases an attempt was made to obtain time series data for the past fifteen years for the eight-county Philadelphia Metropolitan Statistical Area. The following series have been collected for the region, or part of the region:

Philadelphia Region

Employment in the Philadelphia SMSA - thirty two-digit SIC series - Bureau of Employment Security, Department of Labor, Commonwealth of Pennsylvania

Help Wanted Ads - Greater Philadelphia Facts

Commerce of the Port of Philadelphia - Greater Philadelphia Facts

Telephones in Service - Bell Telephone Company of Pennsylvania

Electric Sales - Greater Philadelphia Facts

Index of Sales of Department Stores - Federal Reserve Bank of Philadelphia

Capital Expenditures - Federal Reserve Bank of Philadelphia

Public School Enrollment - adapted from Bulletin Almanac

Population of the Philadelphia Metropolitan Statistical Area - constructed from data obtained from U. S. Census of Population; Division of Resource Development, State of New Jersey; and State Planning Board, Commonwealth of Pennsylvania

Municipal Expenditures, Philadelphia and Camden - Government Division, U. S. Bureau of the Census

Breakdown of Personal Expenditures by Income Class - Wharton School, Bureau of Labor Statistics

Personal Income, 5 county area - Department of Internal Affairs, Commonwealth of Pennsylvania

National Indices

Gross National Product - Survey of Current Business

Index of Manufacturing Production - Survey of Current Business

Net Value of Military Procurement Actions - Statistical Abstract

Consumer Expenditures - Survey of Current Business

Annual average employment data for each of the two-digit manufacturing industries for the Philadelphia SMSA were converted into a value added by manufacture series. This was done by multiplying the employment series in each two-digit manufacturing industry by value added per worker in that industry for each year. Value added per worker was derived from data in the U. S. Bureau of the Census, Annual Survey of Manufactures. Both the Newtonian Formula of Interpolation and straight-line interpolation techniques were used to estimate value added per worker in the years for which data were not available.

Trial correlations between these series and various national and regional indices were run on a desk calculator. An inter-correlation matrix utilizing all fifty-two series is projected using electronic data processing.

* * *

In the next stage of research a set of regional social accounts is being constructed for the Philadelphia area. To accomplish this, the Bill of Goods will have to be disaggregated into the following components:

Personal Consumption Expenditures, disaggregated by Income Groups

Investment in Plant and Equipment

Investment in Manufacturing Construction

Changes in Inventories

Investment in Housing

Investment in Infrastructure

Exports Minus Imports

Federal Government Expenditures in the Region

Defense and Research and Development Expenditures in the Region

State and Local Government Expenditures in the Region

This part of the research is almost completed.

Next we will proceed to disaggregate the Primary Inputs into:

Wages and Salaries

Profits and Interest (Dividends, Profits of Unincorporated Businesses, Rents, etc.)

Taxes (Federal, State and Local)

Transfers

It would be desirable to obtain all these data on a time series basis. The categories of primary inputs for the most part are published for selected years, and an annual series can probably be derived. Personal consumption expenditures by income groups are available for regions only for isolated years. Research is being done on the other categories.

It would be preferable to have the data for these sectors disaggregated into the three- and four-digit SIC industries identical with those of the input-output table. Realistically we hope to obtain the data for the components by two-digit industries.

Consumer expenditures by income classes has been investigated extensively. The Wharton School-Bureau of Labor Statistics study on consumer expenditures for 1950 was used to extract consumer spending for twenty-five categories by income classes. Scatter diagrams of consumption and income were plotted to determine possible relationships between the two in each category.

The Michigan Surveys of Consumer Finances, as well as government studies of consumer expenditures on a national basis, were examined for possible relevance to the Philadelphia region.

Similar studies will be undertaken for the investment function..

Available population data for the Philadelphia SMSA were assembled. Since there is no continuous population time series for the SMSA, one was constructed based on available information. Estimates of missing years were made using the Newtonian Formula of Interpolation.

Attempts were made to correlate population with employment, with several different time lags. No correlation between employment and population in the Philadelphia SMSA was observed. A study of the long-term population trend revealed that it follows a logistic curve.

Forty trial correlations were done on several of the time series to determine their usefulness to the model. In twenty-one cases, the t values were significant.

The following series showed promise for more intensive investigation:

National

Index of Manufacturing Production

Gross National Product

Regional

Port Activity

Expenditures for Plant and Equipment

Public School Enrollment

Percent of Unemployment

Employment in specified industries

Value Added by Manufacture in specified industries

Telephones in Use

Department Store Sales

Electric Sales